

## Thermal Design of the Microwave Instrument for the Rosetta Orbiter

The Jet Propulsion Laboratory leads the development and integration of the Microwave Instrument for the Rosetta Orbiter (MIRO), an instrument that thermally maps the nucleus and coma of comets. Scheduled for a January 2003 launch, MIRO comprises part of the science complement of the Rosetta mission conducted by the European Space Agency. The thermal design of MIRO incorporates both active and passive techniques to accommodate a wide variety of environments expected during the 10.5 year comet rendezvous mission. The MIRO optical bench and adjacent electronic boxes mounted inside the Rosetta spacecraft use active thermal control while the telescope attached to the spacecraft exterior is completely passive. The receivers mounted to the optical bench have a maximum flight requirement of 40°C, but reside in a spacecraft cavity that may reach 50°C. A cantilevered instrument radiator, integral thermal ribs on the optical bench, and a louvered aperture on the side of the spacecraft provide the requisite receiver cooling at perihelion. Thermostatically controlled heaters provide any required heating at aphelion. When the MIRO instrument is powered on, the louver blades move in response to the temperature change from a nearby MIRO electronics box, not the receivers. This uncommon approach was driven by reasons other than thermal, but did not produce any identifiable louver-control problems. Analyses that bound the mission envelope indicate that the proposed design satisfies all thermal requirements. The analytical environmental simulation includes a 0.7 km approach to the Wirtanen comet at the edge of the dust cloud, off-sun illumination of the payload at ten degree intervals and articulation of the spacecraft solar array. The identification and implementation of acceptable thermal design solutions challenge all international partners involved. Schedule differences and the vast distances between partners impede the situation, but mutual cooperation has surmounted the obstacles.